

REMARKS

Section 102 Rejection

Claims 10-51 stand rejected under 35 U.S.C. 102(b) as being anticipated by Fullowan et al (U.S. 5,176,792, hereafter ‘Fullowan’). The Office Action states that Fullowan teaches a method for etching a pattern on a workpiece including the steps of:

selecting a workpiece with a hard mask deposited over a (tungsten) layer to be etched, which hard mask is comprised of a (titanium mask 12) reactive metal (column 1, lines 51-54 and column 2, lines 39-44). The Office Action continues stating Fullowan uses the same hard mask material as described in the claimed invention that would result in the hard mask having a low reactivity to the etch chemistry of an etch process, as in claim 13, and a low sputter yield and low reactivity as in claims 22 and 28.

The Office Action continues stating that Fullowan also teaches, “plasma etching the mask workpiece to selectively remove the unmasked tungsten and performing the etching in a plasma etcher that is water-cooled to room temperature (column 2, lines 55-61), reading on: processing the workpiece in a reactor using an etch step and exposing the hard mask to the etch.

The Office Action continues stating Fullowan further teaches a layer predominantly comprising tungsten can be formed into precise patterns having substantially vertical walls by using titanium as a mask and plasma etching in a fluorine-containing plasma such as CR₄ or SF₆ . . . Each step in the process can be effected without subjecting the workpiece to voltage magnitudes in excess of 200 volts or temperatures outside the range between room temperature and 200 C (column 1, lines 51-64), which reads on, providing energy to the reactor, in claim 10; and

oxidizing the hard mask either prior to or during heating by exposing the hard mask to a stream of oxidizing gas, in claim 51; and

which encompasses said step of providing energy at a temperature in the range from about 80 to about 300 C° in claim 11, since Fullowan uses the same method of providing energy, which encompasses the temperature range of the claimed invention. The Office Action further indicates that using Fullowan's method of processing of a wafer would inherently result in slowing the rate of erosion of the hard mask by providing energy to the reactor in order to increase a rate of oxidation of the hard mask, as in claims 10, 13, 22, 25, 26, 28, 29, 30 and 34.

Reply

This rejection is respectfully traversed.

Initially, in contrast with Fullowan, claims 16, 17, 20, 32, 44, 48 and 51 claim exposing the mask to a stream of oxidizing gas as part of the oxidation process to increase the oxidation rate of the hard mask to slow erosion in addition to increasing temperature. Fullowan does not teach or disclose introducing such a stream of oxidizing gas to enhance the oxidation process. Fullowan (col. 1, lines 51-64), as recited in the Office Action above regarding claim 51, does not mention using a stream of oxidizing gas. Applicants, thus, maintain that claims 16, 17, 20, 32, 44, 48 and 51 are allowable as not anticipated by Fullowan.

Further, Fullowan does not indicate that energy is added in order to increase the rate of oxidation of the hard mask, as claimed in independent claims 10, 13, 22, 25, 26, 28, 29, 30 and 34, in contrast with the Office Action. As stated in Fullowan (col. 1, lines 51-64), and as recited in the Office Action, "each step in the process can be affected without subjecting the workpiece to voltage magnitudes in excess of

200 volts or temperatures ... between room temperature and 200°C." By indicating that the process is affected "without" excess voltages or temperatures, Fullowan teaches away from adding energy as claimed. Fullowan (col. 2, lines 55-61), also recited in the Office Action, further teaches away from adding energy to increase the rate of oxidation by disclosing "a plasma etcher that is water-cooled to room temperature." Accordingly Applicants maintain independent claims 10, 13, 22, 25, 26, 28, 29, 30 and 34 are allowable as not anticipated by Fullowan.

Claims dependent on the independent claims recited above are believed allowable as not anticipated by Fullowan, based at least on their dependence on these claims.

Conclusion

In light of the above remarks, claims 10-13, 15-17, 19-40, 42, 44 and 46-49 and 51 are all believed allowable as not anticipated by Fullowan. Accordingly, reconsideration and allowance of these claims is respectfully requested.

No fee is believed due with this response. Should a fee be due, the Commissioner is hereby authorized to charge any deficiencies to Deposit Account No. 06-1325.

Respectfully submitted,

Date: 4/16/04

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